THE BEECHWOODS OF THE VÉRTES MOUNTAINS III.

AN INVESTIGATION OF SIMILARITY OF STANDS*

by

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Introduction

The question of the similarity of stands (s.l.) is one of the fundamental problems of the phytocenology. This problem is closely connected with that of the contraction and separation of the relevés, stands (s.str.), communities, etc.; and with the question of the ordination and classification.

Regarding the existing conceptions and the methods following from them, there is a considerable diversity in this field, all over the world. Some excellent reviews on such are those by Greig – Smith (1957, 1964), Dagnelie (1960), McIntosh (1967).

From these works and from the recent literature some coincidences appear: 1. the use of empirical similarity indices (e.g. the Jaccard-index, the Sørensen-index, etc.) is not satisfactory, because of a lack of theoretical foundation.

2. There is no adequate method for comparing stands, taking into account the quantitative characters of the species.

3. Therefore, the most authors investigating the relations of similarity use one of the ordination techniques and calculate only from the floristical data (presence and absence of species).

4. Using whichever method, we must not consider the stands indepently from their floristical environs (i.e. the other stands), when intending to compare them. The question of the similarity would namely lose its basis of reference and so its meaning, too, if the subject were not treated in that way.

* This paper is a part of the Ph. D. thesis of the author.

Materials and method

Our materials were taken from the beechwoods of the Vértes mountains (Transdanubian part of Hungary). The short physical characterization of the mountains, the location of relevés, the description and analysis of the stands by means of the methods of the Zürich – Montpellier school are found in the first paper of this series (S z ő c s 1972). The basic data were: 18 relevés originating from 6 stands. The relevés were carried out in the usual manner of the school mentioned above (each of them in a quadrate of 20×20 m). There were 95 species found in the 18 relevés altogether. Only the presence- and absence-values of species were taken into account. The data concerning the average value of the age of the stands originate from the competent Forestry.

Starting from the well-known 2×2 contingency-tables, the matrix of correlation coefficients (W e b e r 1957) was calculated. Although it contains nearly all information that can be extracted from the basic data, this matrix is hardly suitable for direct evaluation. Therefore, there are many methods for the analysis of its structure. We have chosen the factor analysis (D a g n e l i e 1960, L a w l e y and M a x w e l l 1963, H a r m a n 1967), because its result bears an ecological meaning, and could help as a "compass" in possible future ecological investigations. Among the different techniques of factor analysis, the centroid method seemed to be suitable for our purposes and possibilities.

Results and discussion

In the course of the factor analysis, starting from the correlation matrix (Table I.), two factors and their loadings were calculated (Table II.) by two iterations. These two factors substracted 73 per cent of the variance.

Table I.

The matrix of correlation coefficients

	I	II	III	IV	V	VI
I	1.000	0.362	−0.280	0.270	−0.126	0.183
II	0.362	1.000	0.157	0.416	0.207	0.083
III	−0.280	0.157	1.000	−0.043	0.097	−0.362
IV	0.270	0.416	−0.043	1.000	−0.005	0.097
V	−0.126	0.207	0.097	−0.005	1.000	−0.267
VI	0.183	0.083	−0.362	0.097	−0.267	1.000

Table II.

The matrix of factor-loadings

	I. factor	II. factor
I	0.678	0.199
II	0.287	0.553
III	−0.357	−0.308
IV	0.474	0.377
V	−0.270	−0.411
VI	0.573	−0.410

Ordination by one axis

1. Ordination by the first factor (Fig. 1.). It can be seen that the first factor divides the set of stands into two subsets: *a)* III. – V.
b) II. – IV. – VI. – I.

This separation shows that the first factor has an effect of very different degree or of contrary direction on the variables.

Fig. 1. Ordination by the first factor

Regarding the geographical configuration and position of the six stands (see Szőcs 1972), one could assume that the distribution of rainfall and the water-budget of the stands had an eminent role among the components (i.e. the really effective ecological factors) of the first factor.

This hypothesis is supported by the following: *a)* Stand I. taking in an extreme position both in real space and on the first axis, is situated on the top level of the plateau which is the probably most "mountaneous" part of the Vértes mountains.

b) The sequence of stands I. – IV. – II. – III. on the first axis exactly corresponds to that in space. Moreover, this is the direction of the gradient vector of the distribution of rainfall in Transdanubia, too.

The two remainding stands (VI. and V.) also fit into this sequence not by their geographical, but owing to their orographical position. The stand VI. is at the bottom of a deep corrie, so its water supply is most favourable. The stand V. is just on the contrary situated on a steep slope of the lee side of the plateau (SE).

2. Ordination by the second factor (Fig. 2.). The second factor also divides the stands into two groups, but these are different from the former ones: the stand VI. comes to the other group.

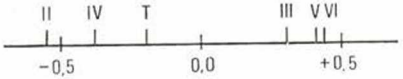

Fig. 2. Ordination by the second factor

There is a remarkable difference between the average values of the ages of the two groups: the group of the stands I. – IV. – II. is 117 years old, while the other group of the stands III. – V. – VI. is only 71 years old (as a mean of the average values of the individual stands), respectively.

Therefore, among the ecological components of the second factor presumably those play an important role which change in a considerable degree with the age of stand. Through these ecological factors the difference of age existing between the two groups could cause a remarkable difference in the floristical composition of the stands and especially in the herbaceous vegetation constituting the majority of the species.

Ordination by two axes (Fig. 3.)

As a result of a common effect of the two factors, the set of stands falls into three parts.

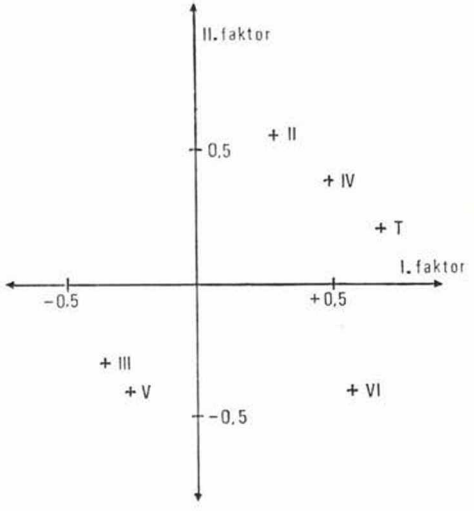

Fig. 3. Ordination by the first and the second factors

The group of stands I.—IV.—II. is the oldest (of 100—130 years), and take place on the horizontal level of the plateau (350—450 m). It is most interesting that their position in the factor-space corresponds nearly exactly to their real arrangement. They are approximately in a straight line on the map, too, and the stand IV. is half-way between the two others. The conclusion can be drawn, therefore, that both factors have some components changing in a considerable degree within the mountains in SW-NE direction.

The stands of the second group (stands III. and V.) are younger than those of the former one, and take place on a slope of 20—40°. In consequence of their position, they get less precipitation and utilize it with lower efficiency than the former stands.

Stand VI. is different from all others. According to its age, it could be drawn into the second group; on the basis of the water-budget, however, into the first one. So, it could not be ranged with either, and is considered a certain kind of transition between them.

The distance from the origin did not show any notable difference among the three groups. This means the two factors affect the six variables (i.e. the floristical composition of the six stands) with an approximately equal intensity.

Summary

The floristical similarity of six stands of the beechwoods of the Vértes mountains (Transdanubian part of Hungary) was studied by FA (centroid method). Two factors were calculated, they substracted 73 per cents of variance.

1. The geographical distribution of annual average of precipitaion and the water-budget of the stands, and

2. them average age of the stands

were assumed to be the most important among the really effective ecological components of the first and second factors, respectively.

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